MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2016/2017

BQT1614 – QUANTITATIVE ANALYSIS

(All sections / Groups)

10 MARCH 2017
9.00 a.m. - 12.00 p.m.
(3 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of TEN **(10)** printed pages inclusive of the cover page, formulae sheet and statistical tables.

2. This question paper consists of **FIVE** structured questions. Attempt **ALL** questions.

3. Students are allowed to use non-programmable scientific calculators with no restrictions. Statistical tables are attached at the end of the question paper.

4. Please use **pen** to write the answers.

5. Please print all your answers in the **Answer Booklet** provided.

Question 1 [Total = 20 Marks]

a) Monthly rent data in ringgit for a sample of 10 one-bedroom apartments in Cyberjaya are as follows: 620, 710, 720, 865, 610, 840, 1095, 935, 805, and 950.

(i) Find the point estimate of the population mean and standard deviation for the monthly rent of one-bedroom apartments in Cyberjaya. [3 marks]

(ii) Determine the interquartile range for the monthly rent of one-bedroom apartments in Cyberjaya. [5 marks]

(iii) Determine the sample size required to be 90% confidence with the estimation of mean within ± RM10 given that the population standard deviation is RM115. [3 marks]

b) A statistics professor classifies his students according to their grade point average (GPA) and their gender. The accompanying table gives the proportion of students falling into the various categories. One student is selected at random.

GPA

Gender	Under 2.0	2.0 – 3.0	Over 3.0
Male	0.05	0.25	0.10
Female	0.10	0.30	0.20

(i) Find the probability of the selected student to score GPA for at least 2.0. [2 marks]

(ii) Find the probability of the selected student to neither has GPA under 2.0 nor a female. [4 marks]

(iii) Find the probability of the selected male student to score over 3.0. [3 marks]

Question 2 [Total = 20 Marks]

a) A large self-service gas station experiences an average of 1.6 "drive-offs" (a customer drives away without paying) per week.

(i) Find the probability that more than 1 drive-offs per week. [3 marks]

(ii) Find the probability of three drives-offs during weekends. [3 marks]

(iii) How much is the expected loss per month (assuming 4 weeks a month) if each drive-offs causing RM50 of loss. [3 marks]

Continued.....

b) The recent average starting salary for a general manager working in banks in a small town is $27,500. Assume salaries are normally distributed with a standard deviation of $5,500.
   (i) What percent of starting salaries is no more than $32,250? [3 marks]
   (ii) What is the probability of a manager receiving a starting salary between $25,000 and $40,000? [5 marks]
   (iii) What is the cutoff for the top 5% of the salaries? [3 marks]

Question 3 [Total = 20 Marks]

Recently, a corporation randomly selects 150 salespeople and finds that 99 of them who have never taken a self-improvement course would like such a course. The firm did a similar study 10 years ago in which 64 from a random sample of 160 salespeople were not interested with such self-improvement course. The groups are assumed to be independent random samples.

a) Using the test statistics approach test whether this proportion of those interested with self-improvement course has improved from the previous study. [17 marks]
b) Determine the p-value of the test. [3 marks]

Question 4 [Total = 20 Marks]

A company wants to study the relationship between an employee's length of employment and their number of workdays absent. The company collected the following information on a random sample of seven employees.

Number of Workdays Absent	2	3	3	5	7	7	8
Length of Employment (in yrs)	5	6	9	4	2	2	0

a) Find the coefficient of determination and interpret your answer. [5 marks]
b) Determine the least square regression equation. [4 marks]
c) Interpret the slope. [3 marks]
d) Test at 5% significance level whether length of employment has significant impact on the number of workdays absent provided the standard error of the slope to be 0.179. [8 marks]

Continued...

Question 5 [Total = 20 Marks]

a) Over five-year period, an original principal of $2000 accumulated to $2950 in an account in which interest was compounded every 3 months. Determine the nominal interest rate. [4 marks]

b) Suppose you have the choice of taking out RM18,000 loan at 8% compounded quarterly for either 15 years or 30 years.
   (i) Find the repayment amount for each choice. [5 marks]
   (ii) How much you can save if you were to choose the 15-year loan? [4 marks]

c) Alex deposits $1000 at the end of every 3 months into an account with annual interest of 10%. What is the value of the account at the end of $7\frac{1}{2}$ years? [3 marks]

d) Macy is one of the tuition teachers working in one famous tuition centre at Klang and her take-home pay and the CPI for 2010 and 2015 are:

Year	Take-Home Pay	CPI (1990=100)
2010	RM 25000	152.4
2015	RM 41200	172.2

   (i) Calculate her real income for both years. [3 marks]
   (ii) How much is her increment from year 2010? [1 mark]

End of Questions

STATISTICAL FORMULAE

A. DESCRIPTIVE STATISTICS

Mean $(\bar{x}) = \dfrac{\sum_{i=1}^{n} X_i}{n}$

Standard Deviation $(s) = \sqrt{\dfrac{\sum_{i=1}^{n} X_i^{\,2}}{n-1} - \dfrac{(\sum_{i=1}^{n} X_i)^2}{n(n-1)}}$

Coefficient of Variation $(CV) = \dfrac{\sigma}{\overline{X}} \times 100$

Pearson's Coefficient of Skewness $(S_k) = \dfrac{3(\overline{X} - Median)}{s}$

B. PROBABILITY

P (A or B) = P (A) + P (B) – P (A and B)

P (A and B) = P (A)× P (B) if A and B are independent

P (A | B) = P (A and B) ÷ P (B)

Poisson Probability Distribution

If X follows a Poisson Distribution , $P(\lambda)$ where $P(X = x) = \dfrac{e^{-\lambda}\lambda^x}{x!}$

then the mean = $E(X) = \lambda$ and variance = $VAR(X) = \lambda$

Binomial Probability Distribution

If X follows a Binomial Distribution B(n, p) where $P(X = x) = {}^nC_x p^x q^{n-x}$

then the mean = $E(X) = np$ and variance = $VAR(X) = npq$ where $q = 1 - p$

Normal Distribution

If X follows a Normal distribution, $N(\mu, \sigma)$ where $E(X) = \mu$ and $VAR(X) = \sigma^2$

then $Z = \dfrac{X - \mu}{\sigma}$

C. CONFIDENCE INTERVAL ESTIMATION AND SAMPLE SIZE DETERMINATION

(100 – α) % Confidence Interval for Population Mean (σ Known) = $\mu = \overline{X} \pm Z_{\alpha/2}\left(\sigma/\sqrt{n}\right)$ (100 – α)% Confidence Interval for Population Mean (σ Unknown) = $\mu = \overline{X} \pm t_{\alpha/2,n-1}\left(s/\sqrt{n}\right)$
(100 – α)% Confidence Interval for Population Proportion = $\pi = p \pm Z_{\alpha/2}\sqrt{\frac{p(1-p)}{n}}$
Sample Size Determination for Population Mean : $n \geq \left[\frac{(Z_{\alpha/2})\sigma}{E}\right]^2$ Sample Size Determination for Population Proportion : $n \geq \frac{Z^2 \times p(1-p)}{E^2}$ Where E = Limit of Error in Estimation

D. HYPOTHESIS TESTING

One Sample Mean Test	
Standard Deviation (σ) Known	**Standard Deviation (σ) Not Known**
$Z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$	$t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$
One Sample Proportion Test	
$Z = \frac{p - \pi}{\sqrt{\frac{\pi(1-\pi)}{n}}}$	

Two Sample Mean Test	
Standard Deviation (σ) Known	**Standard Deviation (σ) Not Known**
$z = \dfrac{(\overline{x_1} - \overline{x_2}) - (\mu_1 - \mu_2)}{\sqrt{\sigma_1^2/n_1 + \sigma_2^2/n_2}}$	$t = \dfrac{(\overline{x_1} - \overline{x_2}) - (\mu_1 - \mu_2)}{\sqrt{S_p^2\left(1/n_1 + 1/n_2\right)}}$ where $S_p^2 = \dfrac{(n_1-1)S_1^2 + (n_2-1)S_2^2}{(n_1+n_2-2)}$
Two Sample Proportion Test	
$Z = \dfrac{(p_1 - p_2) - (\pi_1 - \pi_2)}{\sqrt{\bar{p}(1-\bar{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$ where $\bar{p} = \dfrac{X_1 + X_2}{n_1 + n_2}$; $p_1 = \dfrac{X_1}{n_1}$; $p_2 = \dfrac{X_2}{n_2}$	
where X_1 and X_2 are the number of successes from each population	

E. REGRESSION ANALYSIS

Simple Linear Regression

$Y_i = \beta_0 + \beta_1 X_1 + \varepsilon_i$ Where $\beta_0 = \overline{Y} - \beta_1 \overline{X}$ and $\beta_1 = \dfrac{\sum XY - \left[\dfrac{\sum X \sum Y}{n}\right]}{\left[\sum X^2 - \left((\sum X)^2/n\right)\right]}$

Correlation Coefficient

$$r = \frac{\sum XY - \left[\dfrac{\sum X \sum Y}{n}\right]}{\sqrt{\left[\sum X^2 - \left((\sum X)^2/n\right)\right]\left[\sum Y^2 - \left((\sum Y)^2/n\right)\right]}} = \frac{COV(X,Y)}{\sigma_X \sigma_Y}$$

ANOVA Table for Regression

Source	Degrees of Freedom	Sum of Squares	Mean Squares
Regression	*1*	SSR	MSR = SSR/1
Error/Residual	*n – 2*	SSE	MSE = SSE/(*n – 2*)
Total	*n – 1*	SST	

Test Statistic for Significance of the Predictor Variable

$t_i = \dfrac{b_i}{S_{b_i}}$ and the critical value = $\pm t_{\alpha/2,(n-p-1)}$

Where p = number of predictor

F. INDEX NUMBERS

Simple Price Index $P = \frac{p_t}{p_0} \times 100$	**Laspeyres Quantity Index** $P = \frac{\sum p_0 q_t}{\sum p_0 q_0} \times 100$
Aggregate Price Index $P = \frac{\sum p_t}{\sum p_0}(100)$	**Paasche Quantity Index** $P = \frac{\sum p_t q_t}{\sum p_t q_0} \times 100$
Laspeyres Price Index $P = \frac{\sum p_t q_0}{\sum p_0 q_0} \times 100$	**Fisher's Ideal Price Index** $\sqrt{(Laspeyres\ Price\ Index)(Paasche\ Price\ Index)}$
Paasche Price Index $P = \frac{\sum p_t q_t}{\sum p_0 q_t} \times 100$	**Value Index** $V = \frac{\sum p_t q_t}{\sum p_0 q_0} \times 100$

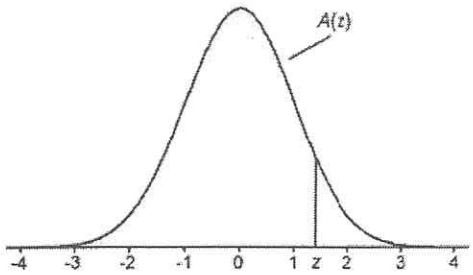
G. FINANCIAL MATHEMATICS

Simple Interest $I = Pnr$ $A = P(1+nr)$	**Compounded Interest** $I_t = P[(1+i)^n - 1]$ $A_t = P(1+i)^n$
Effective Rate of Interest $r_{\text{effective}} = \left(1 + \frac{r}{m}\right)^m - 1$	**Sinking Fund** $S = R\left[\frac{(1+i)^n - 1}{i}\right]$
Future Value $A_t = P(1+i)^n$	**Present Value** $P = A(1+i)^{-n}$
Future Value of an Annuity $FV_A = R\left[\frac{(1+i)^n - 1}{i}\right]$	**Present Value of an Annuity** $PV_A = R\left[\frac{1-(1+i)^{-n}}{i}\right]$
Amortization $R = \left[\frac{P(i)}{1-(1+i)^{-n}}\right]$	

STATISTICAL TABLES 1

TABLE A.1

Cumulative Standardized Normal Distribution

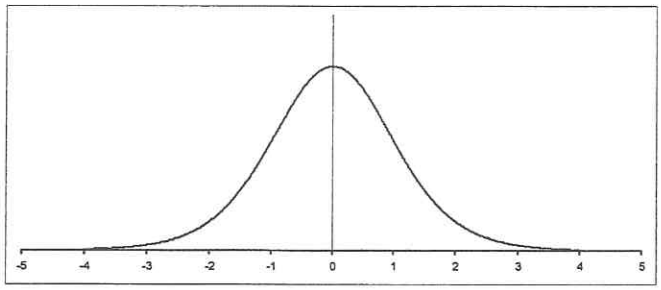


$A(z)$ is the integral of the standardized normal distribution from $-\infty$ to z (in other words, the area under the curve to the left of z). It gives the probability of a normal random variable not being more than z standard deviations above its mean. Values of z of particular importance:

z	$A(z)$	
1.645	0.9500	Lower limit of right 5% tail
1.960	0.9750	Lower limit of right 2.5% tail
2.326	0.9900	Lower limit of right 1% tail
2.576	0.9950	Lower limit of right 0.5% tail
3.090	0.9990	Lower limit of right 0.1% tail
3.291	0.9995	Lower limit of right 0.05% tail

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999							

Table 2: The t-distribution ($t_{\alpha, n-1}$)



α =	0.10	0.05	0.025	0.01	0.005	0.001	0.0005
(n-1) = 1	3.078	6.314	12.706	31.821	63.657	318.309	636.619
2	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	1.319	1.714	2.069	2.500	2.807	3.485	3.768
24	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	1.296	1.671	2.000	2.390	2.660	3.232	3.460
120	1.289	1.658	1.980	2.358	2.617	3.160	3.373
∞	1.282	1.645	1.960	2.326	2.576	3.090	3.291